WHAT IS CLAIMED IS:

1. A sensor system, comprising:

a nanosensor comprising at least one conductive channel comprising an array of substantially aligned carbon nanotubes or carbon nanofibers embedded in a matrix material;

a first electrode electrically contacting the carbon nanotubes or carbon nanofibers on a first portion of the at least one conductive channel;

a second electrode electrically contacting carbon nanotubes or carbon nanofibers on a second portion of the at least one conductive channel.

2. The sensor system of claim 1, wherein:

the nanosensor comprises a polymer matrix film containing the carbon nanotubes or carbon nanofibers;

the carbon nanotubes or carbon nanofibers generally extend in a direction parallel to a thickness direction of the polymer matrix film; and

the carbon nanotubes or carbon nanofibers are substantially aligned in a plurality of conductive channels extending in the polymer matrix film in a direction substantially perpendicular to the thickness direction of the polymer matrix film.

3. The sensor system of claim 1, wherein:

the nanosensor comprises a polymer matrix containing the carbon nanotubes or carbon nanofibers; and

the conductive channels comprise the carbon nanotubes or carbon nanofibers extending length wise through the polymer matrix such that opposing ends of the carbon nanotubes or carbon nanofibers are exposed in opposing faces of the polymer matrix.

4. The sensor system of claim 1, wherein the nanosensor is adapted to provide information relating to a physical condition of a first material in contact with the nanosensor due to variations of current flowing through the nanosensor between the first and second electrodes.

5. The sensor system of claim 4, wherein:

the current flowing through the nanosensor between the first and second electrodes varies due to at least one of bending, twisting, breaking, static accumulation, and thermal induced changes of the carbon nanotubes or carbon nanofibers; and

the information relating to a physical condition comprises at least one of thermal effects, stress, strain, static build up, crack content, fracture content, and breakage content of the first material.

6. The sensor system of claim 1, further comprising:

a power supply adapted to provide a current through the nanosensor between the first and second electrodes;

a detector adapted to detect variations in conductivity of the carbon nanotubes or carbon nanofibers by detecting the variations in the current through the nanosensor between the first and second electrodes; and

a data processing device which is adapted to determine at least one of thermal effects, stress, strain, static build up, crack content, fracture content, and breakage content of the first material in real time based on the variations in conductivity detected by the detector.

7. The sensor system of claim 6, wherein:

the first material comprises at least one of aircraft wing and aircraft chassis material; and

data from the data processing device is provided to at least one of a flight crew and a ground crew of the aircraft.

8. The sensor system of claim 4, wherein the first material is located in at least one of a building, industrial machinery and a movable vehicle.

9. The sensor system of claim 1, wherein:

the array of substantially aligned carbon nanotubes or carbon nanofibers comprises an array of selectively grown carbon nanotubes arranged in predetermined locations in the matrix material;

the carbon nanotubes have diameters less than 1 μm and lengths greater than 1 μm; and

the matrix material comprises a polymer film.

10. The sensor system of claim 1, wherein the first and second electrodes are selected from a group consisting of Schottky contacts, pn junction diode contacts, metallic ohmic contacts, conductive organic contacts and semiconductor contacts.

11. The sensor system of claim 10, wherein the first and second electrodes are selected from a group consisting of bulk chip structures, thin films and wires.

12. The sensor system of claim 2, wherein the nanosensor is flexible and adapted to be removable from the first material.

13. The sensor system of claim 4, wherein the nanosensor is further adapted to act as at least one of an anti-static coating, a thermal conductor, an antenna and a structural reinforcing material.

14. A movable vehicle, comprising:

a movable vehicle body;

at least one sensor system of any one of claims 1 to 13 incorporated into or in contact with the vehicle body.

15. The movable vehicle of claim 14, further comprising a data processing device which is adapted to receive information from the at least one nanosensor and to determine a real time physical condition of the vehicle body.

16. The movable vehicle of claim 15, wherein:

the movable vehicle comprises an aircraft;

the aircraft comprises a plurality of the sensor systems;

the nanosensors of the respective sensor systems are incorporated into or are located in contact with at least one of a wing and a chassis of the aircraft; and

data from the data processing device is provided to at least one of a flight crew and a ground crew of the aircraft.

17. The movable vehicle of claim 15, wherein the movable vehicle is selected from at least one of a car, truck, bus, boat, train, space vehicle, satellite, rocket and missile.

18. An antenna, comprising an array of substantially aligned carbon nanotubes or carbon nanofibers embedded in a matrix material wherein carbon nanotubes or carbon nanofibers are adapted to function as an antenna by wirelessly receiving and/or transmitting information.

19. The antenna of claim 18, wherein the antenna further comprises a send/receive circuit electrically connected to the carbon nanotubes or carbon nanofibers.

20. The antenna of claim 18, wherein the carbon nanotubes or carbon nanofibers are substantially aligned in at least one conductive channel in the matrix material.

21. The antenna of claim 20, wherein:

the matrix material comprises a polymer matrix film containing the carbon nanotubes;

the carbon nanotubes generally extend in a direction parallel to a thickness direction of the polymer matrix film; and

a plurality of conductive channels comprising the substantially aligned nanotubes extending in the polymer matrix film in a direction substantially perpendicular to the thickness direction of the polymer matrix film.

22. The antenna of claim 21, wherein the antenna is incorporated in or located on a surface of a body of an airplane, rocket or missile.

23. A method of determining a physical condition of a material comprising:

providing at least one nanosensor incorporated into or in contact with the material, the at least one nanosensor comprising at least one conductive channel comprising an array of substantially aligned carbon nanotubes or carbon nanofibers embedded in a matrix material;

receiving information from the at least one nanosensor; and

determining the physical condition of the material based on the information from the at least one nanosensor.

24. The method of claim 23, further comprising applying a voltage to the at least nanosensor between a first electrode electrically contacting the carbon nanotubes or carbon nanofibers on a first portion of the at least one conductive channel and a second electrode electrically contacting the carbon nanotubes or carbon nanofibers on a second portion of the at least one conductive channel such that a current flows through the at least one nanosensor.

25. The method of claim 24, wherein:

the nanosensor comprises a polymer matrix film containing the carbon nanotubes or carbon nanofibers;

the carbon nanotubes or carbon nanofibers generally extend in a direction parallel to a thickness direction of the polymer matrix film; and

the carbon nanotubes or carbon nanofibers are substantially aligned in a plurality of conductive channels extending in the polymer matrix film in a direction substantially perpendicular to the thickness direction of the polymer matrix film.

26. The method of claim 24, wherein:

the nanosensor comprises a polymer matrix containing the carbon nanotubes or carbon nanofibers; and

the conductive channels comprise the carbon nanotubes or carbon nanofibers extending length wise through the polymer matrix such that opposing ends of the carbon nanotubes or carbon nanofibers are exposed in opposing faces of the polymer matrix.

27. The method of claim 24, wherein:

the step of receiving information from the at least one nanosensor comprises receiving real time information by continuously detecting variations in current flowing through the at least one nanosensor between the first and second electrodes; and

the step of determining the physical condition of the material comprises determining a real time physical condition of the material.

28. The method of claim 27, wherein:

the current flowing through the nanosensor between the first and second electrodes varies due to at least one of bending, twisting, breaking, static build up and thermal induced changes of the carbon nanotubes or carbon nanofibers; and

the step of determining a real time physical condition of the material comprises determining at least one of thermal effects, stress, strain, static build up, crack content, fracture content, and breakage content of the first material from changes in conductivity of the nanosensor.

29. The method of claim 28, further comprising a step of analyzing the information received from the at least one nanosensor, comprising:

a) providing data representative of a change in at least one of thermal and electric conductivity of the at least one nanosensor;

b) determining whether the change is due to shifts of the nanosensors or actual fractures by comparing the change to previously stored data;

c) incrementing a point in a relevant stress, strain, thermal, DC and AC position as a reference data-point is compared against it; and

d) placing the data into a grid pattern for mathematical analysis and go/no go options.

30. The method of claim 29, further comprising determining whether the values of the physical conditions are within acceptable tolerance and at least one of signaling or displaying an alarm if at least one value of the physical condition is outside acceptable tolerance.

31. The method of claim 30, further comprising the step of displaying the determined values of the physical conditions.

32. The method of claim 29, further comprising the following steps in relative order:

a) normalizing a collected and stored thermal and electrical conductivity data;

b) comparing the normalized collected and stored thermal and electrical conductivity data;

c) rejecting the thermal and electrical conductivity data if the difference in the comparing step exceeds a predetermined amount.

33. The method of claim 28, wherein the first material comprises at least one of aircraft wing and aircraft chassis material.

34. The method of claim 33, further comprising analyzing a sample signal received from the at least one sensor and comparing it with a reference signal for databasing, in-flight recording and safety analysis.

35. The method of claim 33, further comprising providing the real time physical condition of the material to at least one of a flight crew and a ground crew of the aircraft.

36. A method of making a carbon nanotube composite material, comprising:

providing an array of carbon nanotubes on a first surface of a substrate, wherein the carbon nanotubes in the array are located in a predetermined pattern;

depositing a flowable material comprising at least one of polymer, monomer or oligomer between the carbon nanotubes of the array;

curing the flowable material after the step of depositing to form a flexible matrix film containing a controlled carbon nanotube morphology; and

peeling off the matrix film containing the carbon nanotubes from the substrate.

37. The method of claim 36, further comprising forming electrodes in electrical contact with the carbon nanotubes in the matrix film to form a nanosensor.

38. The method of claim 37, further comprising incorporating the nanosensor into or placing the nanosensor onto a first material, wherein the first material is located in a movable vehicle, industrial machinery or a building.

39. The method of claim 38, further comprising:

electrically connecting a power supply to the nanosensor;

electrically connecting a detector to the nanosensor, the detector being adapted to detect variations in conductivity of the carbon nanotubes in the nanosensor; and

providing a data processing device in communication with the detector, the data processing device being adapted to determine at least one of thermal effects, stress, strain, static build up, crack content, fracture content, and breakage content of the first material in real time based on the variations in conductivity detected by the detector.

40. The method of claim 37, wherein the controlled carbon nanotube morphology comprises:

carbon nanotubes which generally extend in a direction parallel to a thickness direction of the matrix film; and

carbon nanotubes which are substantially aligned in a plurality of conductive channels extending in the matrix film in a direction substantially perpendicular to the

thickness direction of the matrix film, such that the electrodes are in electrical contact with the plurality of conductive channels.

41. The method of claim 36, wherein the step of providing an array of carbon nanotubes comprises:

providing a growth template pattern on the first surface of the substrate; and selectively growing the carbon nanotubes on the growth template pattern.

42. The method of claim 41, wherein:

providing the growth template pattern comprises depositing a catalyst pattern by stamping the first surface of the substrate with a patterned stamp coated with a catalyst;

selectively growing the carbon nanotubes comprises selectively growing the carbon nanotubes on the catalyst pattern by CVD; and

depositing a flowable material comprises depositing a flowable polymer film.

43. The method of claim 42, further comprising controlling a density of the carbon nanotubes selectively grown on the catalyst pattern by controlling a thickness of the catalyst pattern.

44. The method of claim 42, wherein:

the catalyst comprises a poly(styrene-vinylferrocene) copolymer blend;

the matrix material is formed by spinning on a PDMS and curing agent mixture onto the carbon nanotube array and curing the mixture to form a PDMS matrix material; and

the CVD source gas comprises acetylene or xylene.